Lepel

HEATING UP AMERICAN MANUFACTURING

MP MASTER

MA29122

USER MANUAL FOR

LEPEL MODELS

MR 500A
MR1
MR 2.5

LEPEL CORP
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EDGEWOOD, NY 11717

P.N. 13190402

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LEPEL SOLID STATE GENERATORS
MR500A, MR 1, MR 2.5

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SECTION I DESCRIPTION

The new Lepel generators represent the latest "State of the Art" development in solid state induction heating generators.

The design (Patent Pending) provides for greater flexibility and ease in matching a wide range of load coils in the frequency range of 100 to 400 KHz. Further, the circuit operators in a similar fashion as the vacuum tube oscillator. In the design, the power FET device replaces the vacuum tube.

The FET operates such that it's "gate" drawing voltage is always in synchronism with the load output circuit regardless of changes in the output frequency on the load.

In conventional solid state generators, the gate drive voltage is separately developed and must be adjusted in frequency for proper :operation:. The circuits such as "Phase Locked Loop" controlled driver oscillators are frequently employed which have limitation as to response time and the frequency "Capture Ratios". If bridge type inventors are employed, the cross firing of devices in proper sequence must be maintained.

The new circuit is relatively simple compared to the conventional solid state generators, requiring less components, easier to maintain, adjust and operate. Features such automatic compensation with respect to line voltage or changes in generator loading, electronic keying of output for rapid cycling of power, and the interfacing with external instrumentation enhance the utility of this equipment.

The new generators are designed and tested to deliver power output continuously to at

water cooled steel calorimeter from a suitable load coil. The rating is in conformance with the IEEE standards #54 on Induction and Dielectric Heating Equipment's.

In addition to the output tests, the generators are designed and prototype tested to comply with the Federal Communication Commission Rules and Regulations, Part 18, subpart D, (Industrial Heating Equipment) pertaining to interference to communication services.

SECTION II SPECIFICATIONS

MODEL	MR500A	MR 1	MR2.5 / MR 2.5B (black)
DRAWING/TYPE #	19140940	19140935	19140927 / 19141029
RF OUTPUT WATTS	500 (MAX. 600)	1000 (MAX. 1200)	2500 (MAX. 2750)
RF OUTPUT FREQ. RANGE	100 - 400 kHz	100 - 400 kHz	100- 400 kHz
INPUT LINE VOLTS SINGLE PHASE	120 V*	120 V*	208 TO 240
INPUT LINE FREQUENCY	50/60 Hz	50/60Hz	50/60 Hz
INPUT LINE AMPS AT FULL LOAD	6.5	12	15.6
POWER FACTOR F. L.	0.9	0.9	0.9
COOLING	GENERATOR-AIR, COIL AIR OR WAT.	WATER 0.5 GPM	WATER 0.5 GPM
CABINET	19"X16.5"X19.5"	19"X16.5"X19.5"	19"X16.5"X19.5"
WEIGHT, LB.	80	95	110

BLOCK DIAGRAM DWG # 2550023
WATER DIAGRAM DWG# 6580187 (OR DWG# 6580193 FOR MR 500A)

* MODELS MR500A AND MR 1 CAN BE FURNISHED FOR 230 V OPERATION UPON REQUEST.

SECTION III BLOCK DIAGRAM

The "Block Diagram" presents the basic design features of the generators. These features are covered in three sections; (a) Controls, (b)DC Power Supply, (c)R.F. Oscillator :

a) The control system is compressed of various function switches, indicator lights, a manual power potentiometer an electric digital timer ,transformer, access panel interlocks, load meter etc. The controls provide protection to equipment. Electrical interlocks de - energize the power supply upon removing an access panel

b) The DC power supply converts the AC input power of 50 or 60 hertz to direct current, This section is equipped with high speed overload rotation which removes DC power to the R.F. section when a faults sensed. The SCR Power Controller can be adjusted to vary the AC input to the isolation transformer. The output from the latter is fed into the full wave rectifier bridge to convert the AC to DC. The DC output voltage is adjustable from zero to 100% and fed into the R.F. Oscillator section.

c) The R.F. Oscillator section converts the DC power to radio frequency power. The load coil attached to the R.F. output terminals induce energy into metals generating heat. Power transfer efficiency is dependent upon "matching" the impedance of the load coil to the generator output circuit. A special tapped tank coil provides a simple and flexible means of "matching" a wide range of load coils to the generator output circuit.

SECTION IV

POWER CONTROL FEATURES

a) Solid State SCR power control provides continuous adjustment from zero to 100% of power.

b) Manual panel control with a ten turn potentiometer.

c) Automatic control for programming with 0 to 5 mA DC or 4 to 20 mA DC external and remote signal source.

d) DC power supply feedback maintaining DC (RMS) voltage to R.F. section within ± 1% with line voltage variations of ± 10% or load variations from zero to 100% . The regulation of RMS voltage is effective up to 80% of maximum setting of the power control.

e) Output power at any level can be digital timer controlled.

Timing ranges: 0-9.99

0-99.9 seconds, minutes or hours

0-999

f) Power output is electronically keyed "ON" and "OFF" via the SCR power controller circuitry.

g) Provision for local push button control or remote foot switch operation of generator R.F. power.

h) The main line transformer is equipped with an electrostatic shield between primary and secondary to reduce R.F. noise feedback to the power line.

SECTION V. MODES OF OPERATION AND SCR POWER CONTROLLER

MODES OF OPERATION

Two modes of operation are provided, manual and automatic, the selection of which is made through the setting of the manual/automatic toggle switch located on the generator front panel. In the "Manual" position the "Power Control" potentiometer on the front panel controls generator output. In the "Automatic" position, a DC current from a remote device such as a temperature sensor or programmer automatically controls generator power output.

SCR CONTROLLER

The SCR power controller module utilizes two SCR's to vary the generator R.F. output power. The controller applies phase-shifted gate signals to the SCR's which control the AC power to the input of the plate transformer and consequently the R.F. output power of the generator.

The circuit incorporates a "Fast Gate Shutdown circuit" to turn off the SCR's rapidly in the event of a AC current overload thus removing all power from the controller, the isolation transformer and the R.F. section of the generator. Power can be reactivated by pressing the Heat Off-Reset push button on the front panel. The Heat "Start" push button can then be pressed to re-establish "Heat" or R.F. power.

The controller includes three trim potentiometers marked "GAIN", "BIAS", and "OVLD" which are adjusted by removal of caps from holes in rear panel of the generator.

The "OVLD" (Fast Gate Shutdown) adjustments are used plate power must be on, and generator operated in the "Automatic" mode. (see warning note below)

The "BIAS" adjustment sets the minimum control signal level that corresponds to a zero generator R.F. output

The "GAIN: adjustment sets the control signal level required to achieve a maximum generator R.F. output.

SECTION V-A. ADJUSTMENTS FOR 4 TO 20 mA CONTROL RANGE

THE GAIN ADJUSTMENT

Set the control signal level to 20 MA, activate heat power and turn the "GAIN" adjusting screw clockwise to increase load current or counterclockwise to decrease it. Adjust for maximum load current. Maximum load current occurs at that point where continued rotation of the GAIN adjusting screw no longer results in an increasing load current, i.e., Load current ceases to increase when the full line voltage is being applied to the isolation transformer.

THE BIAS ADJUSTMENT

Set the "Auto/Man" toggle switch Auto. Push the "Heat On" button and set the control signal level to 4mA. Turn the "BIAS adjusting screw clockwise in small increments to increase load current or counterclockwise to decrease it. Adjust for a load current reading of zero at the 4 MA input signal.

NOTE: **1.** Since there is some interaction between the "BIAS" and "GAIN" adjustments, it may be necessary to repeat the above procedure several times until both the "BIAS" and "GAIN" operating points are simultaneously stabilized

2. Use a small insulated screwdriver for making these adjustments.

SECTION VI. OPERATING CONTROLS AND INDICATOR LIGHTS

a) Line circuit breaker is a two pole thermal magnetic trip which disconnects the generator from the input lines and protects the equipment in the event of a fault.

b) Illuminated Heat "ON-OFF" push button.

c) Ten turn Manual Power Control Potentiometer.

d) Controls operate 115 Volts AC.

e) Front panel selector switches

"MANUAL-AUTO"

"0-10VDC-4-20MA"

"MANUAL-TIMER"

"PUSH BUTTON-FOOTSWITCH

TIMER

A precision digital timer has been provided to time heat cycles. The front panel selector switch is positioned to "Timer" and initiated with the "Heat" push button on the Foot Switch Assembly.

FOOT SWITCH OPERATION

"ON - OFF" heat can be obtained with the foot switch furnished with the generator.

(a) Set selector switches to "Manual" and "Footswitch".

(b) Insert the footswitch plug into the rear panel receptacle.

(c) Position the line breaker "ON", Power control to zero.

(d) Depress footswitch and adjust power control to desired heat.

CONTROL INDICATOR LIGHTS

a) Heat "READY" (green) part of Heat start push-button

b) "Heat ON" (red) (Part of Stop push-button)

c) Interlock Open (Red)

d) Overload trip (Red)

e) Heat sink temp (Green), (Red for MR-2.5B version)

f) Over frequency (Red)

SECTION VII . PROTECTIVE FEATURES

a) Thermal magnetic Line circuit Breaker equiped with Shunt trip device.

b) "Interlocks" with indicator light - de-energizes the DC Power Supply upon removing a side access panel, but the line voltages are still present..

c) A SCR Controller fault permitting DC Output without activating the "Heat on" circuit is inhibited by automatically tripping the line circuit breaker.

d) SCR power control line current trip with indicator light

e) 115Volt AC controls fused with indicator light.

f) Over frequency limit to protect R.F. section with indicator light.

g) Heat sink temperature limit switches are manually reset with indicator light inadequate water cooling or air cooling of heat sinks de-energizes R.F. section.

h) Main power supply employs an isolation transformer with an electrostatic shield between primary and secondary winding. The use of this transformer reduces R.F. feedback and noise to the power lines.

i) The front panel "Load" meter operates at ground potential.

j) The right side output terminal is grounded internally.

SECTION VIII UNPACKING AND INSPECTION

Before opening the carton inspect the shipment for any sign of damage. cut the metal strapping from the carton, remove all the nails from around the skid base and raise the carton straight u, intact.

The generator should carefully be inspected for damage before attempting installation. If these inspections reveal any damage, report the facts to the carrier immediately and advise you Lepel representative. All components were tested prior to shipment. The carrier is responsible for all damage caused in transit including "concealed damage".

Packed separately are the following items:

1) Footswitch assembly stock #0043-0008

2) Brass adapter fitting for accommodating water cooled load coils fabricated with 1/8" and 1/4" copper tubing.

a) Stock #0626-0012 two (2) 1/4" NPT-1/8" Flare Brass

b) Stock #0626-0020 two (2) 1/4' NPT-3/16" Flare Brass

c) Stock #0626-0018 two (2) 1/4" NPT-1/4" Flare Brass

3) For the model MR-500A. additional copper adapter blocks with hardware are furnished to accommodate "non-water cooled" load coils.

4) Input "Auto" Signal Plug - Stock # 0012-0030

SECTION IX. GENERATOR INSTALLATION

1) The MR-500A, MR-1 and MR2.5 generators are equipped with three wire cables. Two wires are for the single phase lines and a third for the electrical ground. The MR-500A and MR-1 and also provided with a 120 Volt three prong male plug. The third wire is ground.

2) The user should connect the generator to the power lines through a 30 re fusible disconnect switch.

3) The load coil must be connected to the generator output terminals. In the case of the MR-500A, load coils designed with 3/10" copper tubing or larger can be operated without auxiliary cooling. If smaller copper tubing is used. water cooling may be advisable.

   The MR-500A, MR-1 and The MR-2.5 generators have water cooling inlet and outlets located on the rear panel.

4) Use only copper for load coils to minimize power loss. Only brass or copper fittings should be employed

DO NOT USE STEEL FITTINGS IN THE OUTPUT CIRCUIT!!!!!

5) The MR-500A and MR-1 are equipped with 115/230 volt primaries. The MR-2.5 has a primary voltage range of 208/220/230/240 volts. When installing the MR-2.5 generator, the user should measure the line voltage and set the primary tap meanest to that line voltage. All units are operable on 50/60 hertz. In the layout go the three generators, the power supply sections and controls are located on the left side and R.F. section not the right. An aluminum shield between the two sections minimize R.F. noise to the powersection.

GROUNDING THE GENERATOR CABINET

In addition to the electrical service ground, a cabinet ground is recommended. A ground. A ground connection is provided on the rear base of the generator and should be connected by a #8 awg wire or preferably a copper trip, about 1/16 x 2" to a good ground such as a water pipe that runs directly into the earth near the generator.

A satisfactory substitute for a water pipe is a single piece of clean copper or brass rod of at least 1/2' diameter that has been driven vertically into the earth close to the generator, to a depth of at least 8 feet. (Refer to National code, "Made Electrodes") A low impedance connection (e.g., a copper strap 1'" WIDE X 1/32" thick) should also be provided between this terminal and any metallic jigs or fixtures which are used in .

SECTION X. COOLING REQUIREMENTS: THE MR.-500A GENERATOR

The MR-500A is an air cooled unit employing a special blower for cooling of the "Heat Sink". Additionally, the blower circulates air to cool other components. Air is drawn into the cabinet via side panel louvers. While R.F. is "ON" and the cooling is inadequate or the blower fails, a thermal switch located at the top of the heat sink will open at 145deg F to de-energize the power supply. After correcting the cooling fault, the thermal switch must be manually reset by depressing its red reset button. The front panel "Heat Stop" is pressed to reset the controls.

The load coils assigned to the MR-500A are often "Air Cooled". Adapter blocks are provided to connect these coils to the generator output terminals. However, some coils will require water cooling. Provision has been made on the MR-500A for such cooling. The water inlet and outlet for the water cooling of load coils are located at the rear of the cabinet.

The models MR-1 and MR-2.5 are water cooled requiring approximately 0.5 GPM at 20 to 50 psi. The cooling water should be free of foreign matter such as algae growth and carbonates. Impurities should not exceed 170 ppm or 10 grains/gal. with a PH between 6.8 and 7.2 and resistivity not less than 5000 Ohm per cubic centimeter.

Improper cooling is sensed by two thermal switches located at the top of the water cooled "Heat Sink". Temperatures in excess of 125deg F will cause the switches to open circuit and de-energize the R.F. power

Re-energizing R.F. power requires the same "resetting" procedure as outlined in the model MR-500A.

SECTION XI. WATER DRAIN

To insure proper drainage, the water outlets should lead to an open (gravity) drain capable of handling a greater flow of water than that specified for the generator cooling requirements. It should be located close enough to the generator to allow the operator to visually monitor the water flow. When the use of an overhead drain is unavoidable install a check valve in the drain line near the generator to prevent the reverse flow of water.

NOTE: A water recirculator, utilizing a water to air heat exchanger is recommended for use in areas where the water supply is unsuitable for cooling purposes due to high mineral content (hardness exceeds 170 PPM). low resistivity (less than 5000/cm), erratic pressure or very low water temperature.

Lepel corporation has a staff of Field Engineers who are available to install or to supervise the installation of Lepel Induction Heating Equipment.

Water and power lines must be connected, and fixtures and coils must be available when the Field Engineer arrives.

SECTION XII. SAFETY

WARNING: If for any reason, the safety interlock switches are bypassed and the generator is operated with the panels removed, alternating and direct voltages will be exposed. These voltages may be fatal upon contacts

Since residual changes may remain in the capacitors for some time after the generator is shut off, these capacitors should be discharged before servicing..

When in operation, all panels must be securely fastened. When any panel is removed, the safety interlock switch automatically deactivates the Power supply circuits. However, the hazards normally accompanying the servicing the line voltage control circuits are still present and only qualified personnel should be permitted to work on such circuits.

Since high frequency voltages can produce arcs and burns, operators must be instructed not to touch the load coil or load coil leads when the R.F. power is on. appropriate guards must be provided to preclude the possibility of such contact. Since the workpiece may be very hot, both during and for some time after heating, the usual caution associated with such objects should be carefully observed.

NOTE:Where the long load coil lead lengths are required, Lepel can supply coaxial lines which will meet both safety and electrical requirements.

SECTION XIII. OPERATING PROCEDURE

1) The water, power facilities and load coil are connected to the generator.

2) Turn on the water and check for leaks.

3) Remove the right side panel and position the tank coil tap to turn #3. Replace the panel

4) For the initial setup, set the front panel selector switches as follows:

   a) "MANUAL - AUTO" TO "MANUAL"

   b) 0-10V DC--4-20mA" TO "0-10V DC

   c) "MANUAL - TIMER" TO "MANUAL"

   d) "PUSH BUTTON - FOOTSWITCH TO PUSH BUTTON

5) Close the external line switch.

6) Set the generator line circuit breaker to "ON"

7) The following indicator lights will be energized

   a) "START" push button (green)

   b) "HEAT SINK TEMP" (green) (not valid for MR-2.5B version)

8) "MANUAL POWER" set to zero.

9) Located work piece into the load coil.

10) To apply "Heat", press the "Heat Start" illuminated push button. the Heat "OFF"-OVLD RESET" red light is energized.

11) Advance the "MANUAL POWER" control to set the heat level. The "Load" meter indicates the loading.

12) If the "Load" meter reading moves into the red shaded area, the overload system would be activated and de-energize R.F. power. The "OVLD" indicator light is energized.

13) In this case, reduced loading can be attained by repositioning the tank coil tap to lower numbers. This adjustment is made internally on the right side of the cabinet.

14) If increased loading is needed, the aforementioned tank tap is repositioned to higher numbered tank coil tap.

15) In each case, the generator push-button Heat "OFF-OVLD-RESET" must be depressed to extinguish the "OVLD" light.

16) In the case of excessive "LOAD" meter readings, it is not recommended that the overloaded condition be corrected by reducing the "MANUAL POWER" setting.

The alternatives for reducing the load meter reading are:

(a) Readjust the tank coil tap position to lower numbers.

(b) Alter the load coil by increasing the I.D.

(c) Reduce the number of load coil turns.

SECTION XIV. SUGGESTED SPARE PARTS

MODELS MR-500A, MR-1, MR-2.5

SCHEMATIC DESIGNATION	LEPEL STOCK NO.	DESCRIPTION	QTY
C1	0007-0269	Capacitor 0.47uF, 600V	1
A3	0043-0140	Feedback assembly	1
DS1	0027-0005	Lamp - 6.3V #86	1
F	0020-0032	Fuse 250V - 3A	1
K1	0037-0075	Relay 24V DC Coil 2880, DPDT Contacts	1
R7	0038-0280	Resistor 0.3 Ohm, 50W	1
R9	0038-0257	Potentiometer 10K - 10Turns	1
S1	0044-0162	Temp. Switch (125 F) MR1, MR2.5	1
S1	0044-0144	Temp. Switch (160 F) MR-500A	1
TR1	0047-0022	Power FET	2
	0626-0015	Brass Fitting- Output Terminal For 1/8" Tubing	2
	0626-0020	Brass Fitting- Output Term. For 3/16" Tubing	2
	0626-0018	Brass Fitting- Output Term. For 1/4" Tubing	2
	0626-0035	1/4" NPT Bushing to 1/8" Brass Bushing	2
		Copper Adapter Blocks for "Non-Water Cooled load coils (MR - 500A).	2
		Brass Bolt and Nuts for Adapter Blocks	2

ADDITIONAL SAFETY SUGGESTIONS

1. Set the main disconnect switch "OFF" to generator during routine service and maintenance. Use only qualified technical personnel for service.

1.A The access panel interlocks do not remove all power. The main power supply is de-energized but the line input voltage remains applied to the generator.

2. Don't hold or touch parts being heated with R.F. "ON".

3. Ground the generator frame, external heat exchangers, metal tables, fixture and part holders.

4. Discharge stored energy of capacitors with ground hooks before access to generator interior.

5. Don't touch water cooled flexible RF leads while R.F. power is on.

6. Keep metal objects off load coil transformers.

7. Don't operate generators with access panels removed or missing.

8. Install guards to prevent contact of R.F. output leads or load coils by personnel.

9. Watches, rings and other personal metal objects should not be located close to the load coil or R.F. transformer.

10. Do not allow personnel wearing pacemakers to operate the equipment. If such personnel is to work in proximity of the equipment, the pacemaker manufacturer must be consulted for safety approval.

APPENDIX

INSTALLING, OPERATING, AND MAINTAINING MODEL D1000 SINGLE PHASE POWER CONTROL

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SECTION 1
GENERAL INFORMATION

1.1 Introduction

This manual provides the necessary information to install, and operate the Model D1000 Single Phase Trigger. It should be read and understood completely before trying to work with the model D1000. Please feel free to call Automation with any questions you may have **BEFORE** performing installation or start-up.

1.2 Safety

There are certain fundamental warnings which must be kept in mind at all times. These include:

WARNING:
THE D1000 SINGLE PHASE TRIGGER SHOULD BE INSTALLED, ADJUSTED AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE SYSTEM: PERSONAL INJURY AND /OR EQUIPMENT DAMAGE MAY OCCUR IF THE INDIVIDUALS ARE NOT FAMILIAR WITH THE HAZARDS RESULTING FROM IMPROPER OPERATION.

WARNING:
THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE WITH RESPECT TO MOTOR, CONTROLLER AND OPERATOR DEVICE INSTALLATION, WIRING AND START-UP. THE USER IS ALSO RESPONSIBLE FOR UNDERSTANDING AND APPLYING ALL OTHER APLICABLE LOCAL CODES WHICH GOVERN SUCH PRACTICES AS WIRING PROTECTION, GROUNDING, DISCONNECTS AND OVERCURRENT PROTECTION.

1.3 Q.A. Testing

Each unit is carefully tested at the factory prior to shipment. The control must pass both Static and Dynamic performance checks as well as Final Inspection for quality workmanship. A unit is allowed to ship only after acceptance of all aspects of Q.A. Testing and Inspection.

1.4 Storage

If it should become necessary to store the control for any length of time, the follow-

ing precautions should be taken:

- Store the control in a clean, dry (non-corrosive) location that is protected from sudden temperature changes, high levels of moisture, shock and vibration.
- Ambient temperature should be maintained between 0 C and 65 C
- The control should be covered to protect form dust and dirt contamination. (utilize original shipment packaging if available)

Section 2
General Description

2.1 Introduction

The Model D1000 Single Phase Trigger uses a combination of analog and digital circuitry to provide a simple, yet reliable source of power. The trigger is designed to hardfire a back-to-back SCR configuration producing a variable AC output voltage source.

2.2 Control Specification

2.2.1 Input : 120/240 vAC Single Phase

2.2.2 Output : 0 to 120/240 vAC Single Phase
30 Amp continuous
90 Amp peak

2.2.3 Control Reference Input :

A. MANUAL INPUT REFERENCE - An external resistor and potentiometer provides 0 to 10 volts referenced from the internal power supply: or

B. CURRENT INPUT - Optional current input 0 to 20 mA with gain and bias adjustments located on the C1001 option board.

2.2.4 Feedback :

A. OPEN LOOP - The control can be operated open loop by installing a jumper on the tripper control board; or

B. DC FEEDBACK - Provides closed loop control and accuracy of the output voltage with adjustable gain. This signal should be a maximum 10 vAC; or

C. AC RMS FEEDBACK - Also provides closed loop control and accuracy of the output voltage with adjustable gain. This signal should be a maximum 12 vAC.

2.2.5 Current Limiting :

This point is adjustable by the use of an external resistor.

2.2.6 Over Current Trip :

Disable the output firing for overload conditions. The trip point is set between 100% and 200% by the OCT potentiometer and an LED indicator is provided for trip indication.

2.2.7 General Specifications :

- Fully isolated;
- Linear firing of output SCR's with relationship to the applied input command;
- Digital firing logic to provide full 180 firing range of the output SCR's;
- Picket fence hard-firing of output SCR's.

SECTION 3
INSTALLATION AND START UP

3.1 Introduction

The following section contains hook-up notes and drawings for the D1000 Single Phase Tripper and C1001 option board.

WARNING:
THE D1000 SINGLE PHASE TRIGGER SHOULD BE INSTALLED, ADJUSTED AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL EQUIPMENT IN THE SYSTEM: PERSONAL INJURY AND/OR EQUIPMENT DAMAGE MAY OCCUR IF INDIVIDUALS ARE NOT FAMILIAR WITH THE HAZARDS RESULTING FROM IMPROPER OPERATION.

WARNING:
THE USER IS RESPONSIBLE FOR CONFORMING WITH THE NATIONAL ELECTRICAL CODE WITH RESPECT TO MOTOR CONTROLLER AND OPERATOR DEVICE INSTALLATION, WIRING AND START-UP. THE USER IS ALSO RESPONSIBLE FOR UNDERSTANDING AND APPLYING ALL OTHER APPLICABLE LOCAL CODES WHICH GOVERN SUCH PRACTICES AS WIRING PROTECTION, GROUNDING DISCONNECTS AND OVERCURRENT PROTECTION.

3.2 Hook-Up Notes

3.2.1 Input Line and Output Voltage:

A. L1 and L2 are the input lines to the power section 120/240 vAC;

B. L1F and L2F should be fused input lines to protect the control board (see Figure 1);

C. The AC output is 0 to 120/240 vAC single phase, 30 amp continuous, 90 amp peak.

3.3.2 Input Reference Signal:

The Reference signal can either be

A. Manual Input Reference; or
B. Current Input Option.

Each are described as follows:

A. MANUAL INPUT REFERENCE (REFERENCE FIGURE 1) -

1. Attach the "ON/OFF" switch to TB 1 terminal 1 and TB1 terminal 2 (see Figure 1) ;

2. Attach a 5K ohm resistor in series with the low end of a 10K ohm potentiometer and connect as follows:

TB1 Terminal	Connect
1	Other End 5K resistor
4	Potentiometer wiper
5	High End of potentiometer

3. Monitor the voltage at TB1 terminal 4 with a voltmeter referenced to common (TB1-5 or TB1-7);

4. With power applied and the on switch closed, check that the range of the potentiometer is from 0-10 vDC at TB1-4.

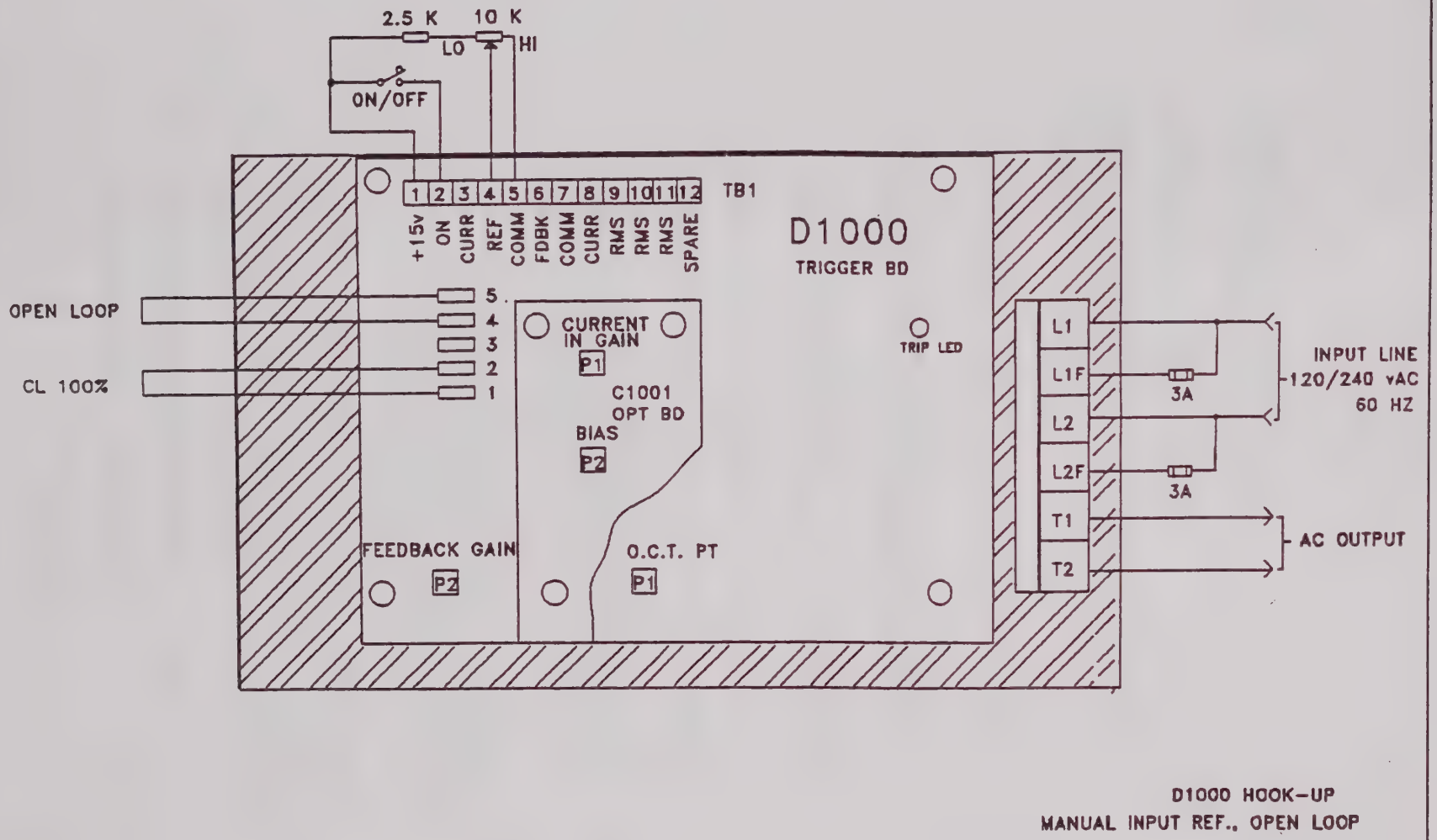
2.5 K
10 K
LO
HI
ON/OFF
1 2 3 4 5 6 7 8 9 10 11 12
TB1
+15v
ON
CURR
REF
COMM
FDBK
COMM
CURR
RMS
RMS
RMS
SPARE
D1000
TRIGGER BD
OPEN LOOP
CL 100%
5
4
3
2
1
CURRENT
IN GAIN
P1
C1001
OPT BD
BIAS
P2
TRIP LED
L1
L1F
L2
L2F
T1
T2
3A
3A
INPUT LINE
120/240 vAC
60 HZ
AC OUTPUT
FEEDBACK GAIN
P2
O.C.T. PT
P1
D1000 HOOK-UP
MANUAL INPUT REF., OPEN LOOP

FIG. 1

B. CURRENT INPUT OPTION
(Reference Figures 2, 2.1, and 3) -

STANDARD = 0 - 20mA

OFFSET MODIFICATION = 4 - 20 mA operation when 750K ohm resistor is present on the bottom of the C1001 Option Board.

1. Attach "ON OFF/RESET" switch as seen in Figure 3 to TB1 terminal 1 and TB1 terminal 2;

2. When using the current input option the external reference potentiometer WILL NOT be used;

3. Turn the bias potentiometer (P2 on the C1001 option board) fully counter-clockwise;

4. Apply maximum current input to TB1 terminal 8;

5. Monitor the voltage at TB1 terminal 3 with a voltmeter;

6. Adjust the input gain potentiometer (P1 on the C1001 option board) for +10v at TB1 terminal 3. This will set the maximum input reference to the control, given the maximum input current;

7. When this point is set at +10v, place a jumper across TB1 terminal 3 and TB1 terminal 4. This will connect the reference signal to the control board. This jumper should be installed after the maximum reference point is set;

8. The Bias potentiometer (P2 on the C1001 option board) can now be adjusted. Continue to monitor the voltage at TB1 terminal 3 with a voltmeter. With an input signal of OmA (4mA for offset modification) at TB1 terminal 8,adjust the bias for the desired output level (see Figure 2, 2.1);

9. The range of the bias potentiometer is as follows:

P2 on option board - Full clockwise = 5V

- Full counter-clock = 0V

CURRENT INPUT OPTION

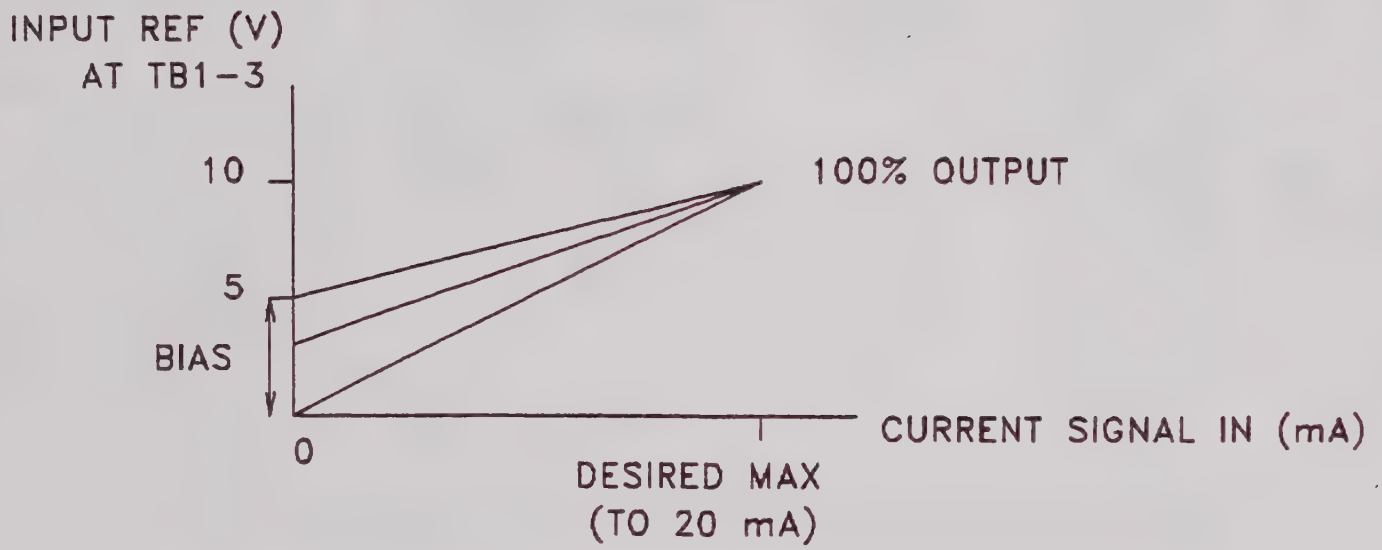

FIG. 2

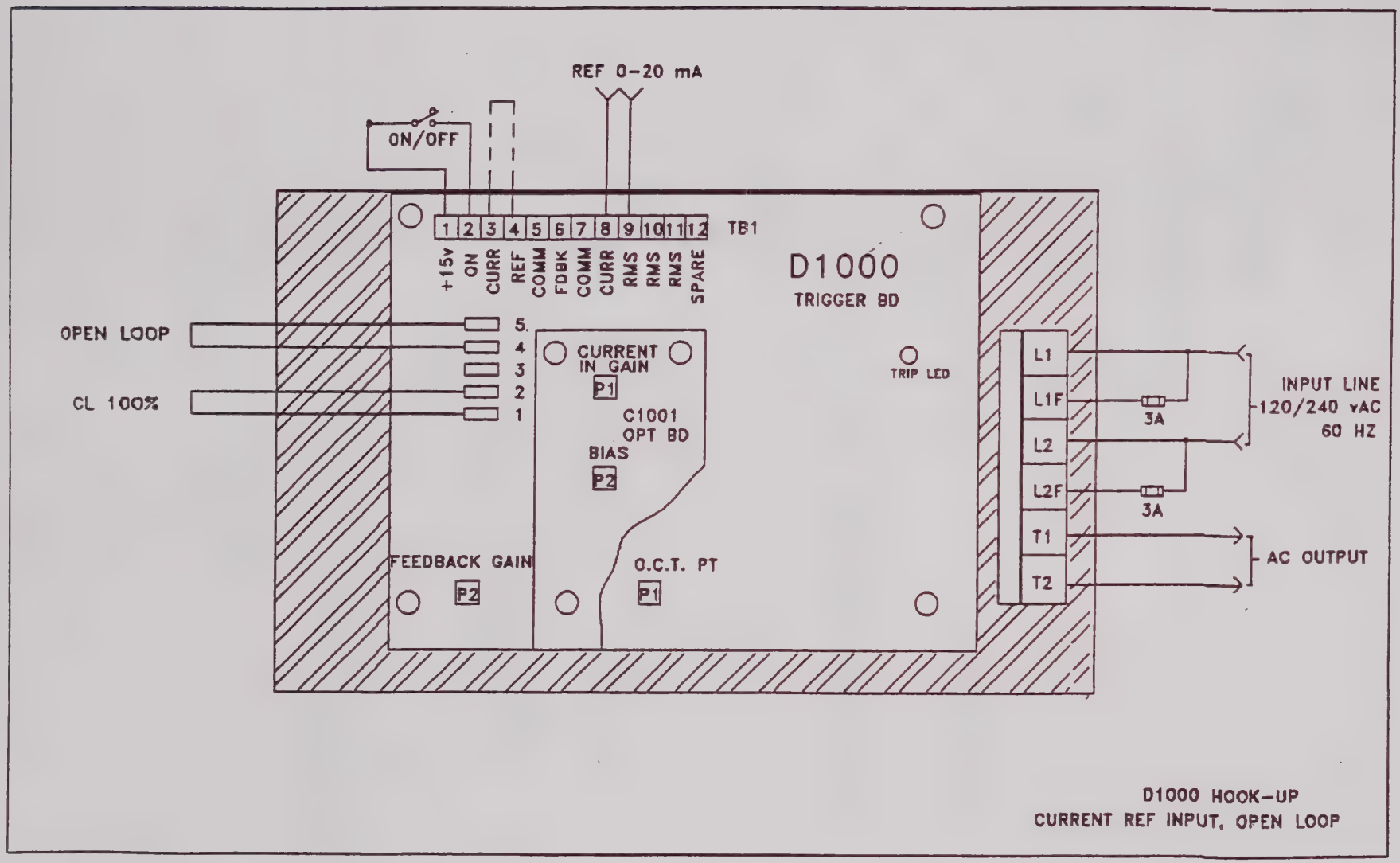
REF 0-20 mA
ON/OFF
1 2 3 4 5 6 7 8 9 10 11 12
TB1
+15v
ON
CURR
REF
COMM
FDBK
COMM
CURR
RMS
RMS
RMS
SPARE
D1000
TRIGGER BD
OPEN LOOP
CL 100%
5
4
3
2
1
CURRENT
IN GAIN
P1
C1001
OPT BD
BIAS
P2
TRIP LED
L1
L1F
L2
L2F
T1
T2
3A
3A
INPUT LINE
120/240 vAC
60 HZ
AC OUTPUT
FEEDBACK GAIN
P2
O.C.T. PT
P1
D1000 HOOK-UP
CURRENT REF INPUT, OPEN LOOP

FIG 3

3.2.3 Feedback :

The Feedback signal can be either

A. Open Loop; or
B. Closed Loop DC; or
C. Closed Loop AC RMS.

Each are described as follows:

A. OPEN LOOP (Reference Figure 1) -

1. Place a jumper between quick disconnect terminal stubs #4 and #5 (see Figure 1 or 3) to establish open loop operation;

2. In the open loop mode the control will regulate on the reference signal only. There should be no signal applied at the feedback point TB1 Terminal 6.

B. STANDARD DC FEEDBACK (Reference Figure 4) -

1. Apply full feedback voltage 1 vDC to 10vDC at TB1 Terminal 6 (see Figure 4);

2. Monitor quick disconnect terminal stub #3 referenced to common (TB1-5 or TB1-7);

3. Apply power, close the "ON/ OFF" switch, apply full reference signal (TB1-4 = +10 vDC) and adjusts the " Feedback Gain " potentiometer P2 on the D1000 Trigger board for -10 vDC at quick disconnect terminal stub #3;

WARNING: THE FEEDBACK SIGNAL AT QUICK DISCONNECT TERMINAL STUB #3 SHOULD BE AS CLOSE AS POSSIBLE TO -10 vDC WITHOUT EXCEEDING IT WHEN THE FULL ON REFERENCE SIGNAL IS +10vDC AT TB1-4.

4. The DC feedback signal is typically high impedance (Z = 10K ohms).

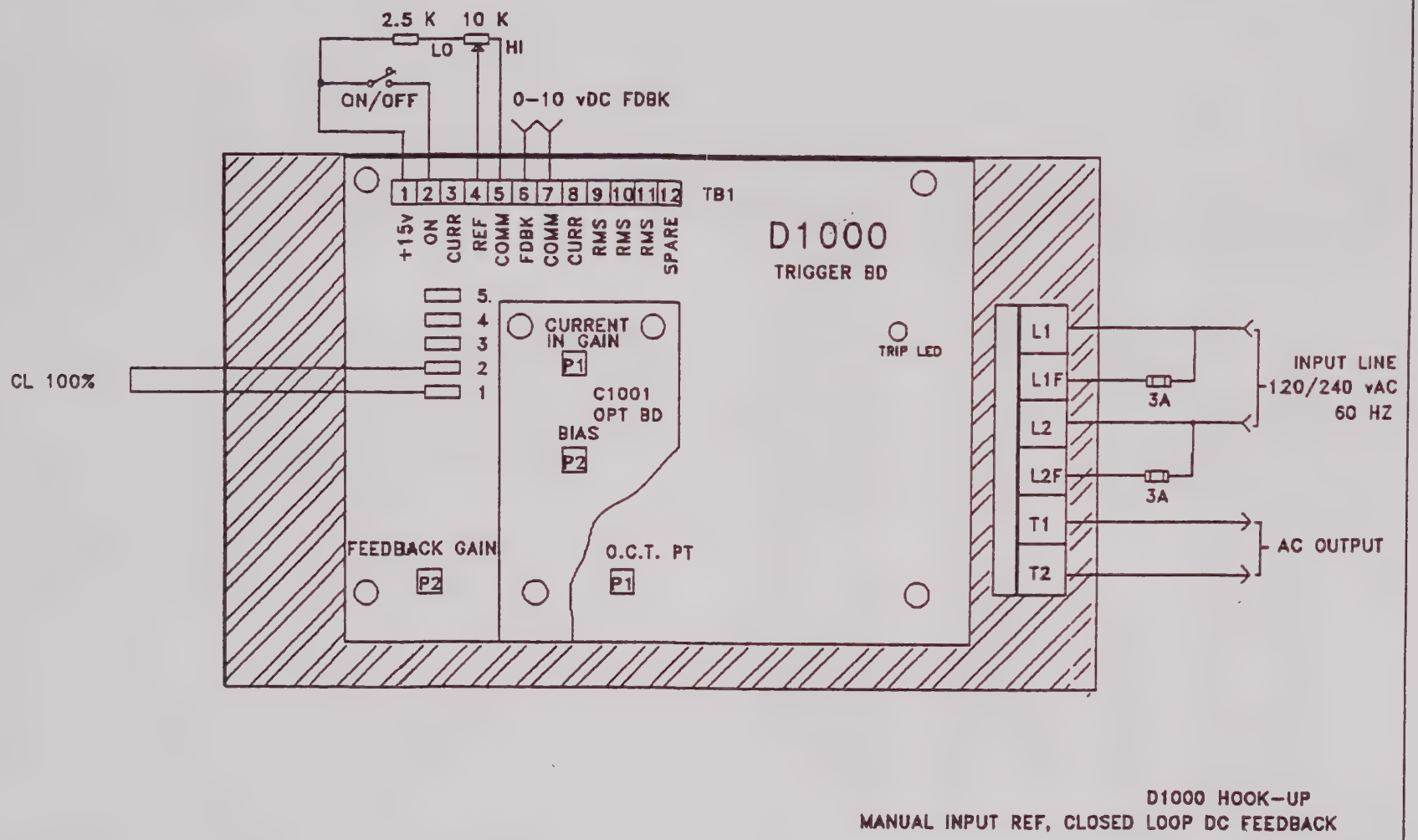
2.5 K
10 K
LO
HI
ON/OFF
0–10 vDC FDBK
1 2 3 4 5 6 7 8 9 10 11 12
TB1
+15v
ON
CURR
REF
COMM
FDBK
COMM
CURR
RMS
RMS
RMS
SPARE
D1000
TRIGGER BD
5.
4
3
2
1
CURRENT
IN GAIN
P1
C1001
OPT BD
BIAS
P2
TRIP LED
CL 100%
L1
L1F
L2
L2F
T1
T2
3A
3A
INPUT LINE
120/240 vAC
60 HZ
AC OUTPUT
FEEDBACK GAIN
P2
O.C.T. PT
P1
D1000 HOOK–UP
MANUAL INPUT REF, CLOSED LOOP DC FEEDBACK

FIG. 4

C. RMS FEEDBACK (Reference Figure 5) -

1. Connect a jumper from TB1 Terminal 9 to TB1 Terminal 6 to establish AC RMS feedback operation (see Figure 5);

2. Apply a feedback signal no greater than 12 vAC to TB1 Terminal 10 and TB1 Terminal 11.

3. Monitor quick disconnect terminal stub #3 referenced to common (TB1-5 or TB1-7) ;

4. Apply power, close the "ON/OFF" switch, apply full reference signal (TB1-4 = =10 vDC) and adjust the "Feedback Gain" potentiometer P2 on the D1000 Trigger board for -10 vDC at quick disconnect terminal stub #3;

WARNING: THE FEEDBACK SIGNAL AT QUICK DISCONNECT TERMINAL STUB #3 SHOULD BE AS CLOSE AS POSSIBLE TO -10 vDC WITHOUT EXCEEDING IT WHEN THE FULL ON REFERENCE SIGNAL IS +10 vDC AT TB1-4.

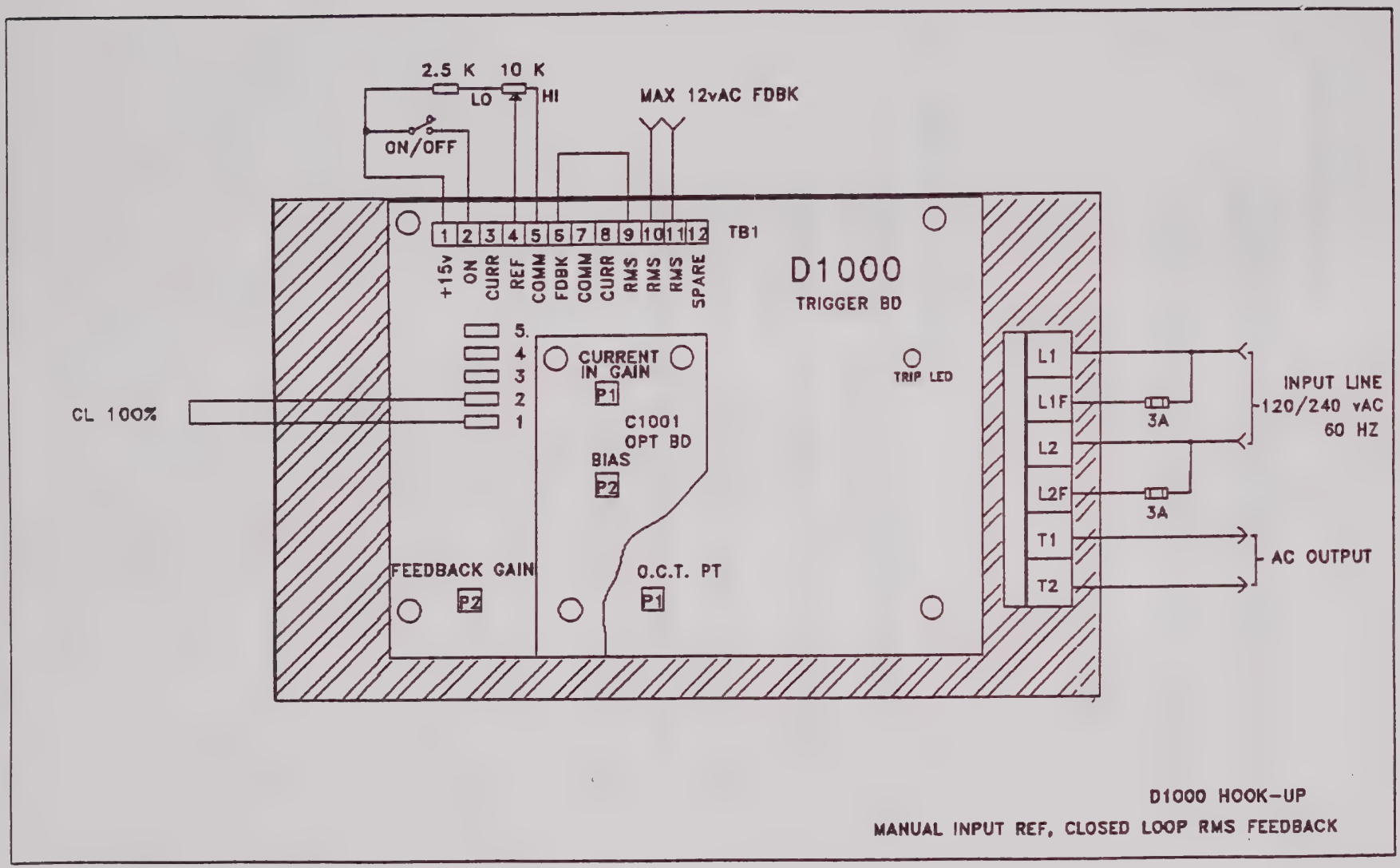
2.5 K
10 K
LO
HI
ON/OFF
MAX 12vAC FDBK
1 2 3 4 5 6 7 8 9 10 11 12
TB1
+15v
ON
CURR
REF
COMM
FDBK
COMM
CURR
RMS
RMS
RMS
SPARE
D1000
TRIGGER BD
5.
4
3
2
1
CL 100%
CURRENT
IN GAIN
P1
C1001
OPT BD
BIAS
P2
TRIP LED
L1
L1F
L2
L2F
T1
T2
3A
3A
INPUT LINE
120/240 vAC
60 HZ
AC OUTPUT
FEEDBACK GAIN
P2
O.C.T. PT
P1
D1000 HOOK-UP
MANUAL INPUT REF, CLOSED LOOP RMS FEEDBACK

FIG. 5

3.2.4 Current Limit Point :

A. The current limit point is set by placing a resistance between quick disconnect terminals #1 and #2 (see Figure 1) ;

B. The following chart should be used to set the current limit point:

Resistor	Current Limit Point
0K ohms	100%
20K ohms	75%
40K ohms	50%

3.2.5 Over Current Trip Point :

A. Potentiometer P1 on the D1000 Trigger Board adjusts the point which the control will over current trip;

B. A red LED on the right side of the Trigger board indicates a trip when illuminated;

C. The range of the over current trip potentiometer is as follows:

P1 on Trigger board - Full Clockwise = 250% of full load

Full Counter-clock = 125% of full load

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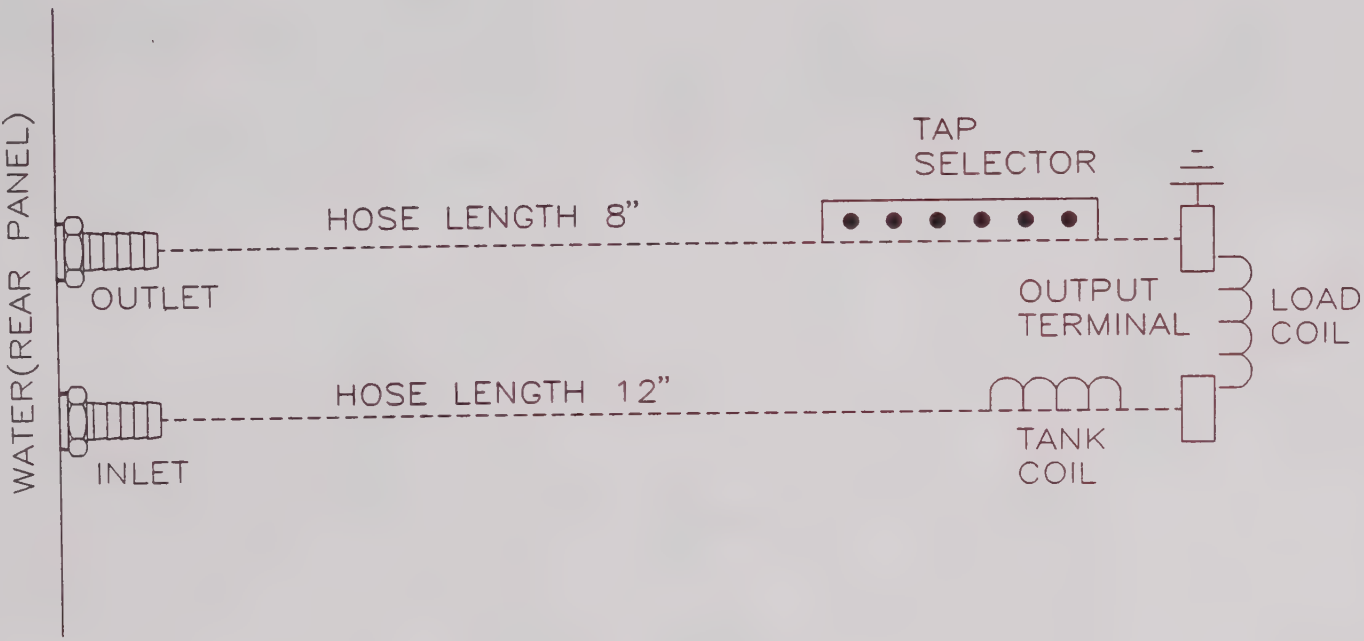
REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL



NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES
TOLERANCE ON:
FRACTIONS ± | DECIMALS ± | ANGLES ±

DRAWN BY RSS DATE 5/15/93
CHECKED DATE
ENGINEER MEL ROSSNICK DATE
JOB No. DATE

NAME
FLOW DIAGRAM, WATER
MR-500A

MATERIAL
FINISH

DWG SIZE A
DRAWING NO. 6580193
REV
SCALE NONE
SHEET 1 OF 1

LEPEL CORPORATION
50 HEARTLAND BOULEVARD
EDGEWOOD, N.Y. 11717

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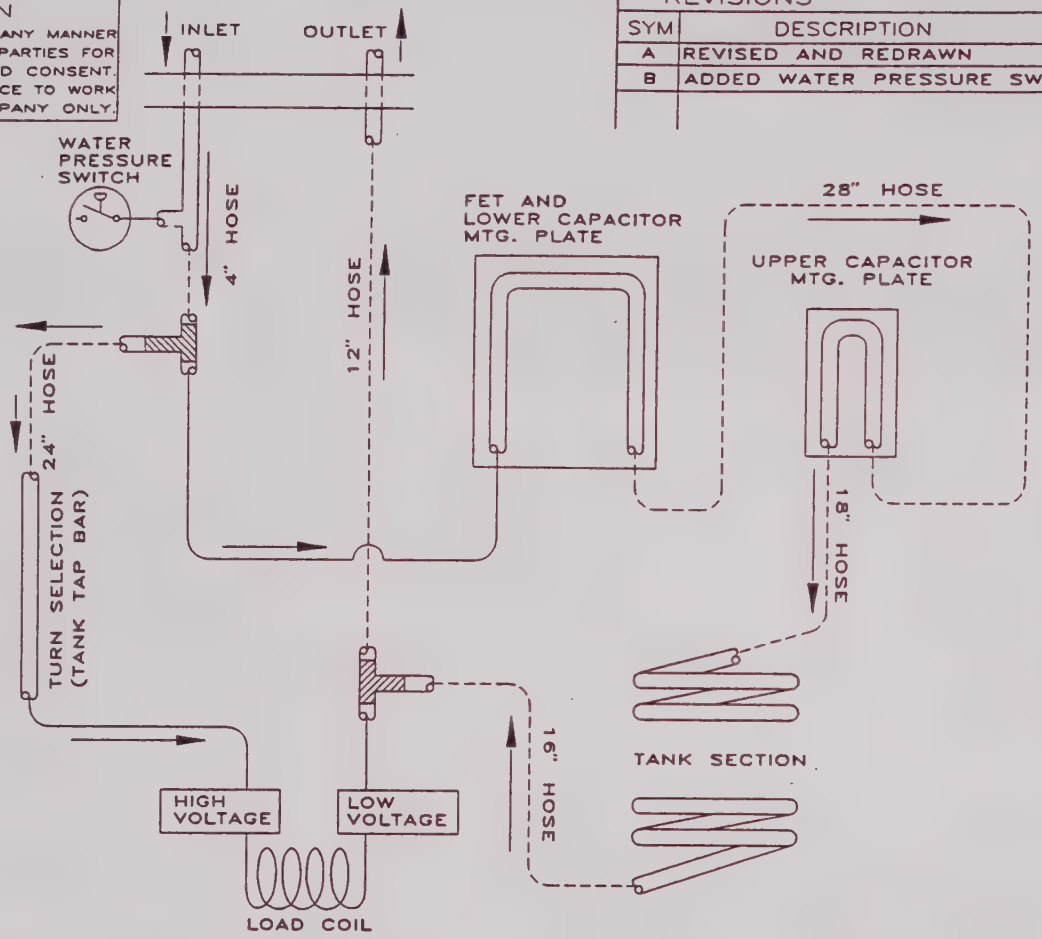
REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
A	REVISED AND REDRAWN	7-22-92	P.L.C.
B	ADDED WATER PRESSURE SW	5/15/93	

RS

NOTES:

SOLID LINE: 3/8" CT
DOTTED LINE: PLASTIC HOSE



	7490004
	7490005
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES
TOLERANCE ON:
FRACTIONS DECIMALS ANGLES
± | ± | ±

DRAWN BY RSS DATE 9-22-92
CHECKED DATE
ENGINEER P.L.C. DATE
JOB No. DATE

NAME
FLOW DIAGRAM – WATER
MR-1; MR-2.5

MATERIAL
FINISH

DWG SIZE A
DRAWING NO. 6580187
REV B
SCALE NONE
SHEET 1 OF 1

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EDGEWOOD, N.Y. 11717

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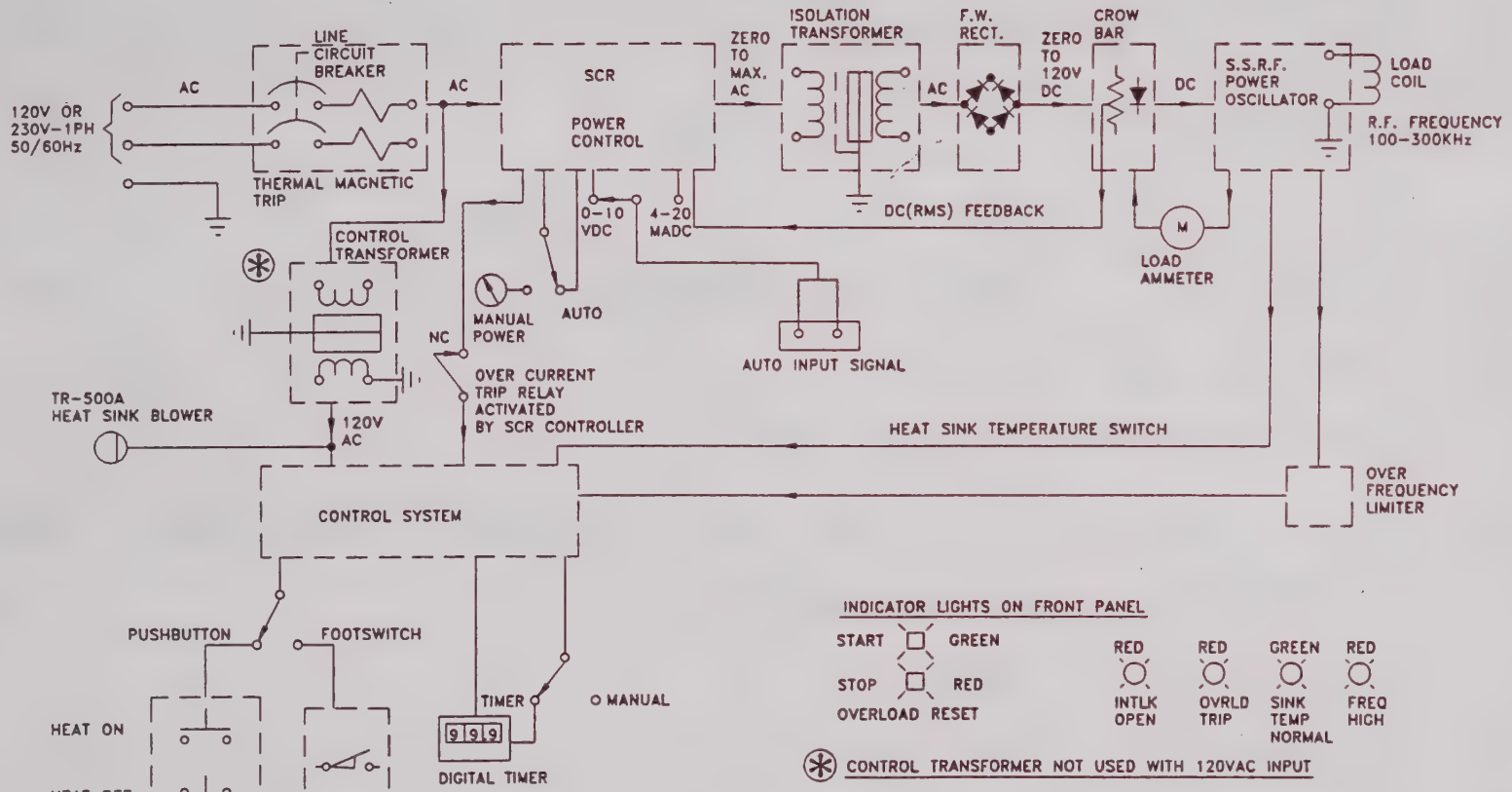
REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVAL



ITEM	QTY	PART NO.	DESCRIPTION	SPECIFICATION	O	UM	TYP

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES
TOLERANCE ON: FRACTIONS DECIMALS ANGLES
± ± ±

DRAWN BY RUSSEL SY DATE 3-24-92
CHECKED DATE
ENGINEER M. ROSSNICK DATE 3-24-92
NEXT ASSY USED ON APPLICATION
JOB No. 1222

NAME: BLOCK DIAGRAM MODELS MR-500A, MR-1, MR-2.5

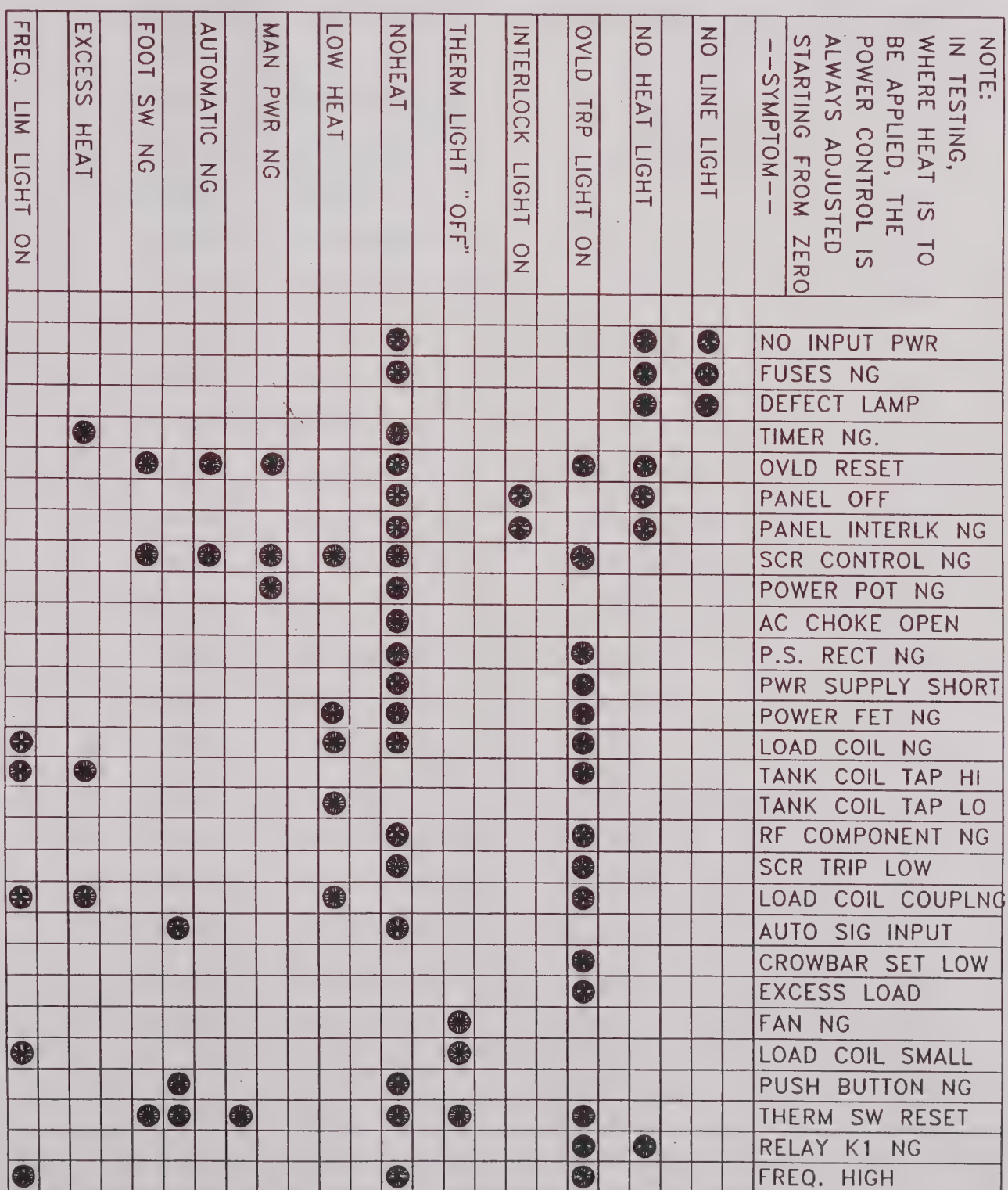
MATERIAL
FINISH

DWG SIZE C
DRAWING NO. 2550023
REV
SCALE NONE
SHEET 1 OF 1

LEPEL CORPORATION
50 HEARTLAND BOULEVARD
EDGEWOOD, N.Y. 11717

-23-

TROUBLESHOOTING GUIDE
MODEL MR500A, MR-1, MR-2.5



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PARTS LIST

MR-2.5 GENERATOR - VERSION B (DWG# 19141029)

REF	STOCK NO	DESCRIPTION	SPECIFICATION	ZONE
A 1	0050-0039	SCR CONTROLLER	220V, 1 ø-30A	C5
A 2	0043-0008	FOOTSWT ASSY.	3 WIRE, 3 PRONG, MALE	A4,A5
A3	0043-0149	FEEDBACK ASSY.		C2
A4	1648-0057	OVER FREQUENCY TRIP		A8
A5	1648-0109	FEEDBACK/RELAY BOARD		D2
B	0005-0011	FAN 100 CFM	115V, 50/60Hz	B6
Ba	0052-0004	CABLE FOR B1		B6
Bb	1908-0003	GRILL FOR B1		
C 1	0007-0270	CAPACITOR	.5 MFD, 1000V DC	C3
C 2	0007-0263	CAPACITOR	0.2MFD, 900V RMS	C1
C 3	0007-0263	CAPACITOR	0.2MFD, 900V RMS	B1
C 4	0007-0263	CAPACITOR	0.2MFD 900V RMS	C1
C 5	0007-0143	CAPACITOR	1 MFD, 50VDC	D5
C 7	0007-0083	CAPACITOR DISK	.005 MFD 1KV	C3
CB1	0009-0105	CIRCUIT BREAKER 2 POLES	20A-230V	C7
D 3	0016-0131	DIODE, BRIDGE	600 VAC, 35A IR#35MB60A	C4
DS1	0027-0027	LAMP 14V "LINE ON"	PART OF S6	D3
DS2	0027-0027	LAMP 14V "HEAT ON"	PART OF S5	D3
DS3	0027-0018	NEON LAMP RED	RED,120V	B5
DS4	0027-0018	NEON LAMP RED	RED,120V	B5
DS5	0027-0018	NEON LAMP RED	RED,120V	B7
DS6	0027-0017	NEON LAMP RED	RED,120V	B6
F1	0020-0032	FUSE	250V, 3A	C7

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PARTS LIST

MR-2.5 GENERATOR - VERSION B (DWG# 19141029)

REF	STOCK NO	DESCRIPTION	SPECIFICATION	ZONE
FET1	0047-0022	POWER FET		C1
FET2	0047-0022	POWER FET		C1
FET3	0047-0022	POWER FET		C1
J 1	0011-0002	RECEPTACLE	TWIST LOCK	B5
J 2	0011-0035	RECEPTACLE	3 WIRE	D3
K 4	0037-0096	RELAY, COIL 4PDT	120V AC COIL	A6/B6
KSH	0037-0092	RELAY, CB SHUNT TRIP		C3
L 1	3621370	TAPPED TANK COIL	WATER COOLED	B2
L1a	12650031	LINK FOR TANK TAP		B2
M 1	0029-0158	DIGITAL METER- DC AMPS	YOKOGAWA (50mV=125%)	C3
M 2	0048-0016	TIMER DIGITAL	EAGLE, 0-99.9 SEC,MIN,HR	B4,D5
PS1	PART OF M1	POWER SUPPLY	YOKOGAWA METER	C4
P 2	0012-0030	PLUG, 3WIRE	USED WITH J2	D3
P 1	0012-0001	MALE PLUG PART OF A2		A5
R 2	0038-0179	RESISTOR	2.5K-25W	C3
R 8	10413-006	RESISTOR	2.7K 1/4 WATT	D5
R 9	0038-0257	POTENTIOMETER	10K, 2W, 10 TURNS	D5
R9a	0412-0003	COUNTER, DIAL	DIAL FOR R9	
RSH	0038-0390	RESISTOR-SHUNT	24 Amp DC @ 50mV	C3
RFC	0008-0105	CHOKE, R.F	(FORM 3"OD) LEPEL	C2
S 1	0044-0173	PRESSURE SWITCH	N.O. CLOSES AT 30PSI	B7
S 2	0044-0162	TEMP SWITCH	N.C. OPENS AT125° +/- 5°F	B7
S 3	0044-0029	PANEL INTERLOCK	SPDT SWITCH	B6
S 4	0044-0029	PANEL INTERLOCK	SPDT SWITCH	B6

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PARTS LIST

MR-2.5 GENERATOR - VERSION B (DWG# 19141029)

REF	STOCK NO	DESCRIPTION	SPECIFICATION	ZONE
S 5	0044-0208	SWITCH ILLUM XFMR	RED LENS "STOP"	B5
S 6	0044-0207	SWITCH ILLUM XFMR	GREEN LENS "START"	B5
S 7	0044-0205	SWITCH, ROCKER	SPDT	B4
S 8	0044-0206	SWITCH, ROCKER	DPDT	C5
S 9	0044-0040	SWITCH, TOGGLE	SPDT	D4
S10	0044-0013	SWITCH, TOGGLE	DPDT	D4
T 1	0049-0439	XFMR, ISOLATION	115/230V, 50/60HZ 3.5 KVA SEC 120V	C4
T 2	0049-0437	XFMR, CONTROL	230V PRI., 115V SEC., 50VA	C7
W 1	0052-0027	POWER CABLE	3 WIRE #12 W/ PLUG 10 FEET	C7
WCL	0034-0039	CLAMP CABLE		
XF	0021-0016	FUSE SOCKET	250V, 20A	C7
XK4	0039-0057	SOCKET	4PDT RELAY	
XX1	20280150	RIGHT COPPER OUTPUT GROUND TERMINAL		
XX1a	20280149	LEFT COPPER OUTPUT HOT TERMINAL		
XX2	16660684	INSULATED MTG PLATE	LEPEL	
XX2a	8320067	WATER COOLED HEAT SINK	LEPEL	

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